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CURRENT NOTES ON CHEMISTRY.—II

[Edited by Charles Platt, Ph. D., F. C. S.]

FLASH POINT OF MINERAL OILS.

WHILE not strictly chemical in its nature there are but few scientific tests so intimately connected with our safety as the determination of the flash and burning points of mineral oils. This has long been a matter of concern to oil merchants alone, but the scientific public is now taking an interest in the matter, which it is hoped will decrease, if not do away with altogether, the vast number of preventable lamp explosions and fatalities.

The safety of an oil is determined by its flash point, that temperature at which an explosion occurs when a flame is applied to the mixture of air and vapor immediately above the surface of the oil. A flash occurs, but the oil does not take fire and burn continuously, in the ordinary test cup, until a higher temperature is reached, its *burning* or *firing* point. Originally the test was applied to the oil in an open cup, but, this method introducing many chances of error, a closed cup was finally adopted, the flame being inserted through a hole in the cover. 100° F., formerly considered as the minimum safety point for oil, in the open cup corresponds to 73° F. in the closed test, and with the adoption of the latter, the British Government, advised by Sir Frederick Abel, lowered the minimum safety point required by law to this temperature! The reports and papers by Sir Frederick Abel and by Mr. Redwood, who was associated with him, contain many outrageous assertions, among others that an oil flashing at a low temperature is more safe than one flashing at a high temperature. They argued that by using the low-test oils a greater volume of vapor is given off and the air is thus driven from the lamp. A metal lamp was also recommended as the safest on this same principle, that by the heating of the oil in the lamp reservoir vapors are evolved from the oil, and the air being driven out as before, an inflammable, but not an explosive, mixture is obtained. When we consider that 73° F., adopted by the British Government, is a temperature frequently exceeded in our houses, the danger of such a ruling is apparent. Mr. D. R. Steuart presented an admirable paper to the Glasgow and Scottish Section of the Society of Chemical Industry, early last winter, in which the fallacies of Abel's position were forcibly shown. His paper was thoroughly discussed by the members at that meeting and subsequently, with the final result of an appointment of a committee of experts to pass upon the question. Their

report fully sustained Mr. Steuart and recommended a higher flash point of minimum safety than that now established by law. Mr. Steuart's paper, presented at that time, and others of more recent date, contain many interesting facts relative to the burning of oils, as, for instance, the relation between flash point and heat developed in burning, the effect of the presence of heavy oils, of chemicals, etc., and of the size of the container.

A lamp burning badly develops more heat than usual, the light is red and the combustion imperfect, producing a disagreeable odor. This may arise from the air not being properly reverberated against the flame; or from the shape of the chimney allowing of back currents; or from the lamp being dirty, the air holes clogged, the wick damp or dirty; the presence of a trace of vegetable or animal oil in the vessels used for filling; or from the oil itself, the presence of heavy oils or refining chemicals. When the oils are not homogeneous, a light and heavy oil being mixed, the heat developed is greater than with either oil separately, this result being more pronounced when a poor wick is used. A well fractionated oil is practically independent of the wick. The treatment of the oil after the last distillation with acid and alkali, results in injury to it, no matter how thorough the final washing. Sulpho compounds of soda are often retained, and these decompose in the burner, forming sulphuric acid, which chars the wick. Carefully fractionated oils are low or high, in flash, in proportion to the specific gravity and boiling point. A low-flashing oil gives the highest temperature in burning. (Contrary to Abel and Redwood).

Another feature has been brought to our attention lately, that of the influence of the size of the containing vessel upon the danger point in oils. The Abel test, it will be remembered, is prescribed as a two-inch cup. A particular sample flashed in Abel test at 78° F.; in the old government open test at 105° F., and *fired* in the old government open test at 122° F. Although a small cup of this oil cannot supply vapor sufficient for a constant flame below 122° F., a larger surface can. The oil above mentioned, tested in an apparatus like the old government open, with a screen around and partly on top, but nine inches in diameter, applying the flame every two degrees, ignited explosively at 88° F. and continued to burn furiously. Applying the flame every degree the same result was attained at 87° F. Transforming the apparatus into a closed test, the oil ignited and burned at 76° F. Except, then, for small surfaces, the flash and burning points are the same, and the Abel flash, becomes a point of danger for oil in store, barrel or tin, while for oil in large vessels, tanks, etc., the danger point is still lower. A case is cited where a large tank of very high flashing oil was being pumped into, the temperature being far below the flash point in Abel cup, vapors were evolved, overflowing through an imperfectly closed manhole at the top, and were ignited at a lamp some distance below. The fire ran back; an explosion resulted, blowing off the top of the tank, and the oil was burned. It is curious to note that while the British Government fixes the flash test at 73° F. for the public, it places the same at 105° F. for its own governmental departments, and at 145° F. for the lighthouses.

EXTRACTION OF FAT FROM FEEDING CAKES.

The extraction of fat from fodder by means of anhydrous ether, after a preliminary drying, or even with low-boiling petroleum, is known to be unsatisfactory. To avoid the simultaneous extraction of coloring matters, resins, waxy impurities, etc., Dr. L. Gebek has conducted experiments, using burnt gypsum mixed with the substance to be extracted, also filtering the ethereal solution through a gypsum filter. Finely powdered gypsum be-

coming impervious during use, a granular material was obtained by powdering plaster figures, igniting and passing through a 2 mm. sieve. The substance was air-dried and ordinary ether used. Anhydrous ether apparently did not affect the results, though these were lowered by a previous drying of the food stuff. The extracts, though pure, were not constant in weight. Spanish earth was found to yield satisfactory results after the following procedure. The fine powder was mixed with water, sufficient sulphuric acid added to remove the carbonates, and the whole evaporated to dryness and ignited. The mineral was then powdered and passed through a 2 mm. sieve. A cotton plug is inserted in the end of the extraction tube, and upon this a layer of 3-4 cm. of Spanish earth, after which a mixture of the earth and fodder and then another plug. 12-15 grammes of the earth were used for 5 grammes of the fodder. With ordinary fodders the results were the same whether hydrous or anhydrous ether was employed, but with foods rich in fat lower results by a few tenths were obtained with the anhydrous. A previous drying of the substance, when Spanish earth is used, gives low results, probably due to the retention of that portion of the fat which may have been changed by the action of the heat.

SYNTHESIS OF PURPUREO-AND LUTEO-CHROMIUM CHLORIDES.

Professor Christensen, of Copenhagen, has produced by direct synthesis the so-called purpureo-and luteo-chromium chlorides, $\text{Cr Cl}_3 \cdot 5 \text{NH}_3$ and $\text{Cr Cl}_3 \cdot 6 \text{NH}_3$. A small quantity of violet chromium chloride, dried at 100° ,* is placed in a beaker and immersed in a freezing mixture of solid carbon dioxide and ether. Liquid ammonia (NH_3) is slowly added. At this temperature no reaction takes place, but upon removing from the freezing mixture and warming to -38.5° , the boiling point of ammonia, a sudden reaction sets in, converting the chloride into a red mass, consisting largely of the purpureo-chloride. The excess of NH_3 is eliminated as gas. The product is washed with cold water and hydrochloric acid, finally dissolved in water and the solution dropped into concentrated hydrochloric, in which the purpureo-chloride is insoluble, when the red crystals of the pure salt are thrown down. The first aqueous washings are yellow and yield a yellow crystalline precipitate of luteo-nitrate upon the addition of concentrated nitric acid. The reaction takes place between very narrow limits—immediately above and below the boiling point of ammonia -38.5° .

DETERMINATION OF GERMANIUM.

Quantitative estimations of the rare metals being unknown to text-books on chemistry, the methods adopted by experienced analysts have a decided instructive value. The following is the procedure in an analysis of the new mineral canfieldite as given by Mr. S. L. Penfield in the *Am. Jour. of Science*. A preliminary qualitative examination was made showing the mineral to be essentially a sulpho salt of germanium and silver. The silver and sulphur were determined as usual. For the germanium, 2 grammes are oxidized with nitric acid, a little sulphuric being added and the excess of nitric removed by evaporation to dryness. The residue is dissolved in water, which has been rendered slightly acid, if necessary, and the silver precipitated with ammonium thiocyanate, filtered and the filtrate containing the germanium collected. The solution is evaporated to dryness in a platinum dish without danger, no acid being present to form with the germanium a volatile compound. The excess of sulphuric acid is driven off by heat, and the ammonium thiocyanate is destroyed by the nitric acid present. The residue is covered with a little strong ammonia (NH_4OH) into which sulphuretted hydrogen is conducted, thus dissolv-

ing the germanium oxide and leaving all heavy metals, except those which form sulpho salts soluble in ammonium sulphide, undissolved. The filtrate from this solution is collected in a platinum crucible and evaporated on a water bath, the residue oxidized by concentrated nitric, and the excess of the latter removed by a second evaporation. The mass in the crucible is now gently ignited and weighed, the germanium being determined as the oxide, GeO_2 . There is no loss of weight on subsequent heating to a red heat.

Another scheme by which all of the determinations are made in one sample is briefly as follows: Solution in nitric; precipitation of the silver by means of hydrochloric; precipitation of the sulphur with barium nitrate; removal of the excess of chlorine and barium, in one operation, with silver nitrate and sulphuric acid; removal of the silver by means of ammonium thiocyanate; and the final determination of the germanium as above.

THE WORLD'S CONGRESS AUXILIARY OF THE COLUMBIAN EXPOSITION.

BY GEO. H. JOHNSON, SC. D., ST. LOUIS, MO.

ONE of the greatest attractions of the Columbian Exposition is outside of the exposition. In the World's Congresses we have an exhibit of the world's intellectual progress and present condition such as has never been attempted before. For the first systematic attempt to make such a comprehensive exhibit of the world's thought by spoken language only the congresses have been very successful. During the whole of the six months that the fair is open the Memorial Art Palace, foot of Adams Street, Chicago, is the place of assembly for those who are prominent in any branch of theoretical and practical learning. At the fair we see the magnificent work of great masters. At the Art Palace we see the great masters themselves. As the creator is greater than his work, as thought is greater than action, so are the world's congresses greater than the fair.

It has been said that President Bonney, since the first day of May, has done nothing but open congresses; and indeed, that is quite sufficient to keep him busy, since several congresses meet each week, and each one is opened by Mr. Bonney with felicitous remarks appropriate to the subject.

Little effort, apparently, has been made here to show the intimate relations which exist between different departments of science and art. To attend one congress and then another exhibits as complete a change as to pass from Machinery Hall to the Fine Arts Building. Since the congresses are designedly meetings for specialists, it is to be expected that very few can take a prominent part in more than one congress. But the wisdom of such a complete separation between dependent and cognate subjects as some of the programs show, is open to question. For example, the Congress on Higher Education did not consider University Extension because the latter subject was considered exclusively in its own congress. The engineering educators could not attend any of the meetings of the civil, mechanical, naval, mining, metallurgical, or military engineers without leaving their own meeting, since all these and others were in session simultaneously.

Perhaps the greatest need of coöperation between closely related specialists was shown in the congresses on experimental and rational psychology. These meetings were held simultaneously in opposite halls of the institute, and each succeeded remarkably well in ignoring the work of their opposite brethren. Indeed, it might have been inferred from some of the remarks that what is experimental is not rational, and what is rational will not bear the test of experiment. A professor in one famous

*Throughout these articles temperatures will be given in Centigrade unless otherwise stated.